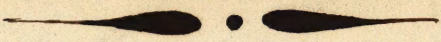


# THESIS.



## TYPHUS FEVER,

ITS DIAGNOSIS AND CHEMICO-PATHOLOGY.

### A THESIS

{FROM NOTES OF LECTURES BY PROF. J. EMERSON KENT. M.D.}


SUBMITTED TO THE FACULTY OF THE

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BY

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white fur and light brown at the centre near the base. Skin dry  
and hot. with occasional moisture. Pulse quick and soft. Urine  
scanty and high colored. Bowels open.

GENERAL SYMPTOMS. Some foldings along the back  
and back. Although the disease is not fatal, it is very  
dangerous.

# TYPHUS FEVER,

## ITS DIAGNOSIS AND CHEMICO-PATHOLOGY.

He who discourses upon Typhus Fever, will not  
be expected to develop a series of astounding nov-  
elties; but he may possibly present some  
points of interest, which, if not wholly new,  
at least possess the merit of practical im-  
portance.

I shall, as briefly as practicable, describe the  
general and special characteristics of this  
yet formidable disease.

SECRECTIONS. Tongue, dotted and coated with a thick



white fur and light brown at the centre, near the base. Skin dry and hot, with occasional moisture. Pulse quick and soft. Urine scanty and high colored. Bowels open.

**GENERAL SYMPTOMS.** Sense of coldness along the back and loins. Alternate shiverings and flushings. Pains in the limbs with lassitude. - Sharp pains in the epigastric and abdominal regions, increased by pressure. - Pain in the head with slight vertigo. - Eyes light and watery. - Complaints of extreme exhaustion.

**GENERAL HISTORY.** Appetite poor for some time, losing strength for a week or two. - increasing daily pallor. - felt general pyrexia yesterday. - thought he had taken cold. - had taken sweets, bitter, &c. (The above, from the notes of my Preceptor, furnishes an ensemble of the general symptoms of the disease, making due allowance for temperament, age, habits of life, employment, &c.)

**THE TONGUE.** The appearance and condition of the Tongue as diagnostics in febrile diseases, cannot be too highly appreciated, and are equally significant of the state of the alimentary canal. We noticed its dotted appearance, a condition



always observable in febrile diseases, and at all times indicative of Fever. It is most marked in children, always found in the prodromic stage of eruptive and continued fever. It may be thus described, - the tips and edges are red, the papillae are also red, shooting up through a white fur.

#### DIAGNOSIS BETWEEN THE DOTTED TONGUE AND THE STRAWBERRY TONGUE OF SCARLATINA.

The dotted tongue is almost always confounded with the strawberry tongue of Scarlatina, it may be observed in the commencement of Scarlatina, but only in the stage common to all fevers. In the strawberry tongue of Scarlatina, the papillae are much more elongated, protruding through a red, raw looking mucous membrane, presenting much the appearance of a ripe, red strawberry, from which it takes its name. In Scarlatina, this peculiarity is presented at the time the eruption is being determined to the surface: (My Preceptor informs me that he has known practitioners who have lost professional credit by diagnosing Scarlatina from the dotted tongue;) hence this distinction is of much practical value.



## DIAGNOSIS BETWEEN THE DOTTED TONGUE AND THE

RED TONGUE. During the progress of Typhus, the tongue often clears off, looking red and glazed. A careless observer might pronounce it clean and normal, but it is indicative of an highly inflamed state of the mucous membrane of the alimentary canal. This diagnosis in Typhus, is always coincident with suppuration of the agminated glands of the ileum. It is not peculiar to this disease, being characteristic of the suppuration of any internal organ, and it also forms one of the symptoms of true rectitis. The red tongue is also found in idiopathic inflammation of the mucous membrane. — In the early stage of Typhus, a blue tinge is seen under the mucous membrane of the tongue caused by venous congestion; as the disease progresses, this tint is obscured by the accumulated fur, which also masks the dotted appearance. — It is at first of a dirty, ashen color, gradually becoming brown or black. Where there is great irritation of the mucous membrane of the stomach, the tongue will remain red at its tip and edges.



THE SKIN will be hot and flushed in proportion to the febrile exaltation, sometimes the face and chest are as red as in Scarlatina, but the absence of the minute papillæ always seen in that disease will prevent any error in Nosology. An offensive effluviu is evolved from the surface, to which I shall hereafter refer.

THE PULSE in Typhus is variable and of little value as a diagnostic of the internal lesions:—as a measure of power, in this as in all other diseases, it is invaluable. It may be quick, strong and bounding, more commonly quick, feeble and soft. With increasing debility it becomes accelerated and weaker, ultimately tremulous and fluctuating, a result induced by subsultus of the heart, proper to the last stage, when the whole muscular apparatus is often spasmodically affected.

THE BOWELS are but seldom relaxed in the commencement of the disease, but this is an important and useful condition, if not excessive, as a sequelæ.

THE URINE. Close attention to this important secretion indi-



cases the internal lesions, and affords a decided prognosis more readily than is at first sight apparent. Admitting the obstacles real or apparent, that may beset the prosecution of chemical analysis, no one will deny the vast importance of such investigations so intimately connected with a correct and successful practice.

By some, a want of time may be urged, by others, a want of scientific, chemical knowledge; but such pleas are futile when contrasted with the advantages gained by chemico-pathological researches, time may be economized, and chemical proficiency readily attained. The unwearied researches of Müller and the philosophical theories of Liebig cannot but impress us with the deep importance of such investigations. The deviations from the normal standards are in Typhus many and marked;—in the early stages the Urine is of greenish tint, charged with phosphate, near its termination it assumes a dark brown color and the acid is predominant.

Before noticing the morbid condition of the Urine, it is proper to note the



## ANALYSIS OF HEALTHY URINE.

Water	933.00
Urea	30.10
Free Lactic Acid, Lactate of Ammonia, Comazone soluble in Alcohol. extractive matter soluble in Water.	17.14
Lithic Acid	1.00
Mucus of the Bladder	0.32
Sulphate of Potash	3.71
" " Soda	3.16
Phosphate " "	2.94
Bi-phosphate of Ammonia	1.65
Chloride of Sodium	4.45
Muriate of Ammonia	1.50
Phosphate of Lime and Magnesia	1.00
Silicia	0.03
	<u>1000.00</u>

THE URINE IN TYPHUS is acid, scanty, high colored and free from albumen. Urea and the Phosphates are in



excess: oily matter abundant, no excess of Uric Acid, it is voided with heat or a cutting sensation; - in the cold stage it is more watery and diminished in quantity: in the hot stage its color is darker, and the Chloride of Silver now throws down a white precipitate, which before it did not. Berzelius supposes this result to be induced by a loss of acid reaction: - whilst Durerney asserts that the Urine is always acid in fevers: it is invariably so in Typhus.

#### ABSENCE OF ALBUMEN FROM THE URINE.

In only a single instance out of numerous experiments, has Albumen been found in any considerable quantity in the Urine of Typhus, and then it did not coagulate, a light pearly opacity alone being apparent, on submitting the sediment to the action of Liquor Potassae, a gelatinous precipitate of a greenish tint was evolved; - doubtless pus, - Albumen being soluble in Potassae, while mucus is thereby rendered more viscid. Graysmeyer says. "if the substance examined be triturated with its own weight of water, and mixed with a saturated solution of Potassae carb, if Pus be



present, a transparent jelly is in a few hours formed, which is not the case if mucos only be contained therein." The pus, in the instance adduced was probably a result of inflammation of the mucous membrane of the urinary passages. We shall again refer to this precipitate, in connection with the coloring matter of Urine. During the latter stages of fever, Nitric Acid will often precipitate minute portions of Albumen, but the amount is too small to demand more than a passing notice; In the case cited, the lungs were much congested, accompanied with a dry, hard skin, but there was neither anasarca or inflammation of the integument. Albumen is present in the Urine in other diseases, particularly in dropsy, and also sometimes where no disease of the kidneys was recognisable either by the symptoms during life, or by post-mortem examination. When anasarca is about the knee, albumen in greater or less quantity is found in the Urine. If during the night, rapid effusion occurs, either into the Chest or Abdomen, albumen is either not present or only in very



minute quantity, the same result is found when the upper half of the body perspires freely, on the contrary, when the skin is dry and harsh, albumen is more abundant in the urine. It may be hence inferred that Albumen in the urine, depends primarily on disturbances of the functions of the skin, and that its quantity is modified by internal conditions of the serous surfaces; an inference corroborated by the facility with which albumen is secreted under the application of any ac-  
tive excitant to the integument. One of the most important, though least observed functions of the skin, is the secretion of Albumen and its presentation as Gelatine. for 1st, as Gelatine is not found in the Blood, it must result from the transformation either of Albumen or Fibrine, (most probably the former, Albumen being the base of all the azotized metamorphoses.) and 2nd, under increased action or suspension of its proper glandular functions, Albumen is actually secreted. Mandl, speaking of the relations between the blood, pus, mucus and the epidermis, says, "their fibrinous globules are identical,



that they differ only in the quantity of the serum in which they are suspended, and that if the fibrinous globules of the blood be fixed upon the surface on which they are secreted, they form epidermoid cells; "if then we view the skin as a glandular organ, and the epidermis as the creation of a rapid and constant excretion, which, interrupted from any cause, must necessarily disorder the functions of the lungs or kidneys, it will be apparent that when the functions of the skin are arrested, the kidneys must eliminate a substance not found in their normal secretion.

We should not however, look for Albumen in the urine, in all cases of interruption of the skin's functions, for it is only when it exists in excess in the system, and when the kidneys fail to effect its transformation into its own peculiar principles, that we should expect to find it in a marked degree in their excretion.

Whenever the functions of the skin are suspended or obstructed, we find a determination of Albumen to the kidneys, and it is excreted therefrom in its undecomposed state; but it is upon the



subsidence of the febrile action, and during convalescence, that Albumen is most usually found in the Urine of Typhus in appreciable amounts. M. Martin, Solon asserted that the presence of Albumen in the Urine during the progress of fevers, is a critical diagnostic of the convalescent stage; but he afterwards renounced that opinion, on the discovery of the error of not having made the important distinction between the precipitates evolved by heat and Nitric Acid and by the latter alone. the former only being Albumen, the latter, Urate of Ammonia. In the Urine of 23 cases of Typhus submitted to chemical analysis, Albumen was found in only four cases, whilst the Urate of Ammonia was obtained in fifteen. The comparative infrequency of Albumen and the period of its elimination corroborate the view herein maintained.

**UREA** is in excess in every stage of Typhus, from its invasion to the reaction of convalescence. As a frequent or nearly universal lesion, in other diseases where Urea is found in the Urine, and not dependent upon a primary affection of the Kidneys, pain in the right hypochondrium is found, denoting either congestion or inflammation.



of the Liver. Where severe dysuria exists, the Liver will always be found affected, and where dysuria is present, it is almost always mistaken for gravel, but if an excess of Uric Acid or of its concretions is thereby meant, a greater error cannot be made: true gravel exists so seldom that it is not seen in Typhus in one case in fifty. In a fluid state (solution) Uric Acid is not an irritant, in the form of calculus, it produces irritation: it is hence assumed that dysuria in Typhus is dependent upon an excess of Urea, which has many properties in common with Nitro, and acts similarly upon the Kidneys. Urea, like Nitro, has a cool, sharp cutting taste, upon the fire it deflagrates, emitting a yellowish white flame, instead of the blue flame of Nitro. Either substance in excess, induces the same excruciating dysuria, a symptom almost always seen during the course of Typhus, and occasionally through its whole progress. - Generally induced by excess of Urea, it may occasionally be caused by ulceration of the mucous membrane, and various neuralgic combinations, but we are only to notice its causes as existing in an excreted fluid.



In Typhus there is always more or less torpor of the Liver, and in its first stages, an arrest to a greater or less degree of its functions, hence the kidneys as the great excretories of the system, carry off the larger portion of the added excrementitious matter, and this state of the Liver is excessive.

Free Uric Acid is also formed in excess, but even in these cases the excess of Urea is the cause of the dysuria, for a mere excess of Uric Acid is not productive of pain.

**TESTS OF UREA.** Let the Urine be evaporated to the consistence of an extract, then dilute with a small portion of distilled water when cold, add Nitric Acid, Nitrate of Urea will be precipitated in white, pearly scales: - dilute with a little more water and add Carb. of Potassa to the exact point of saturation; let it stand until crystals of Nitrate of Potassa are deposited, then pour off the supernatant liquid and evaporate, Urea will be deposited in crystals which may be purified by the usual processes. The annexed is an extremely delicate method of proving the presence of Urea, after the Nitrate of Urea has been formed by the process described,



dissolve it in a small quantity of distilled water, and heat it an iron spoon over a lamp. the Nitrate is decomposed and some of its elements combine with the iron. - transfer this product again diluted, into a glass vessel, and add a small portion of pure Potass, and a beautiful precipitate of Prussian Blue will be thrown down.

**ORIGIN OF UREA.** The excess of Urea in Syphilis, is an absolute demonstration of the law established by Liebig, "that Urea is the result of the decomposition of the nitrogenized tissues of the living organisms." In Syphilis, the patient takes little or no food, yet a considerable excess of Urea is eliminated; and this excess is not merely relative to the quantity of watery particles secreted, but absolute, compared to its normal amount. Whence then its sources, if not from the tissues undergoing decomposition? The formation of Urea in the extreme texture is most likely due to an insufficient supply of Oxygen, whereby Carbonic Acid and Water are not produced in their normal proportions, their elements passing through a series of arrangements resulting in the formation



of new compounds.

**THEORY OF RESPIRATION.** In health, a determinate quantity of Oxygen enters the system by respiration, and it bears a direct relation to the amount of Carbonic Acid expired. In the experiments of Lavoisier, the proportion of oxygen by volume, consumed, compared with the carbonic acid expired, is as 100. to 81.5 a result coincident with the experiments of Davy, hence for all practical purposes, we may assume the excess of oxygen to be one fifth. These numbers are nearly the same as those given by Graham expressive of the different volumes of oxygen and carbonic acid, the former being to the latter, as 95 to 81. Graham's theory of respiration based on the law of diffusion is at once simple and conclusive, it may be thus expressed:—gases displace each other in direct relation to their specific gravities, thus 95 volumes of oxygen occupy more space than 81 volumes of carbonic acid, consequently when the oxygen enters the air cells, it must cause a displacement of their particles, and thus supplies a stimulus necessary to the respiratory movements. It will hence appear



under this law of diffusion (which has never been disputed,) that the oxygen must of necessity displace a smaller quantity of carbonic acid, a fact in accordance with the experiments of Lavoisier, Seguin and Davy.

**FORMATION OF UREA.** From the above data, the erection of a formula showing the production of Urea, Water and Carbonic Acid is easy. We must subtract from fibrine its elements in the proportions necessary to form Urea, then combine the remaining carbon with such a quantity of atmospheric air as may be necessary to change it into carbonic acid. If we now take one fifth of the amount of oxygen taken into the system in excess, adding to it the oxygen yet remaining in the compound, and combine the then whole quantity of oxygen with the remaining hydrogen, the equivalents will be in the exact proportions to form water, thus

	C	H	N	O
Fibrine . . . . .	48	6	36	14
Subtract 3 equivalents of Urea .	6	6	12	6
	42	0	24	8

Now one equivalent of carbon combines with two equivalents of oxygen to form carbonic acid; then 42 equivalents of carbon require 84 equi-



alents of oxygen which enters the system by respiration, with an  
 additional fifth or about 17 equivalents more: - if we add these  
 17 equivalents to the remaining 8, we have 25 equivalents, only  
 one more than the 24 equivalents of hydrogen required for  
 the formation of water: - thus

	C	H.	O
	42	24	8
	<hr/>		
	42	24	109
42 equivs. of Carbonic Acid	C	H.	O
	42		84
24 " " Water		24	24
	<hr/>		
	42	24	108

being only one equivalent less than the number added, and  
 which added number was taken as one fifth, an amount really  
 larger than the actual proportion. It is probable the  
 oxygen of the atmosphere first combines with the carbon and hy-  
 drogen of the fibrine, to form carbonic acid and water, and  
 thus leaves it in the exact proportions to form Urea. But in dis-  
 eases wherein the lungs are in such a condition as to pre-  
 clude the full admission of atmospheric air, a sufficiency of  
 oxygen is not present to effect the decomposition of the  
 carbon and hydrogen, which therefore combines to form oily  
 matter for the purpose of excretion.



## OILY MATTER, COLORING MATTER, AND URIC ACID

may be well considered under one head, as there is a peculiar connection between them, and they also bear a mutual relation in the Urine. The coloring matter may be in excess from an excess of Uric Acid or of the oily matters, the latter are seldom found in great excess, unless there is a large accumulation of the azotized elements in the Urine. In the first stage of Typhus as in all low modes of fever, the Urine generally deposits phosphatic salts, and an oily film will be found on its surface, but even in these cases an excess of Urea or of Uric Acid will be found, except in very rare instances. The alkalis of such Urine after exposure to the atmosphere, form new combinations, and the oily matters they contained are set free; such Urine exhales a strong animal odor during micturition. But we may not suppose that Urine throwing down a dense, white, deposit contains more oily matter, than under circumstances where that property is not apparent, - it is rather presumable that the film is the consequence of the feeble affinity of the acid of the oil and



its base, for when there is an excess of Uric Acid and Ammonia the larger quantity of oily matter is found: - although, after rest, a pellicle may not be formed.

The decomposition of Fibrine is not the only source from whence the oily matter is derived, for there is always an available quantity of adipose matter in the system, and in the incipency of febrile diseases, when the digestive functions are impaired, that is the source from whence the greater part of the oily matter is eliminated by the kidneys, and it shows why it should be in excess in the Urine, when the nitrogenized particles do not so decidedly preponderate. The oily matter is taken up to supply waste, but perverted organic action prevents its passing through the necessary changes, and it is consequently eliminated through the kidneys. But this is not the main source of the oily matter in the Urine in the more advanced stages of the disease, for it is more abundant in Typhus and near the termination of the disease, when there is no fat remaining to be taken up by the absorbents, and when the nitrogenized particles are much more abundant.



COLORING MATTER. The free coloring matter of the Urine is independent of the amount of uric acid, being often intensely deep when but a small quantity of that acid is present, and vice-versa. An excess of this acid in febrile disorders is commonly marked by an excess of coloring matter, and is, while in solution, probably chemically combined therewith. Coloring matter is found in the Urine free, and combined, and the tints of the salts formed from the action of Nitric Acid on Urea may be attributed to the combined coloring matter, this is the opinion of Bouverney. If Liquor Potassae be added to high colored Urine, a greenish tint is at first seen, and subsequently the color almost disappears, if, on the contrary, Nitric Acid be added, the spot on which it falls becomes clearer, with a slight roseate tinge, and the Urine eventually loses its color, this roseate tinge is not deepened by Ammonia. If Liquor Potassae is added to Urine containing an excess of Uric Acid, the green tint is also produced, with the addition of a vivid carmine halo in proportion to the amount of super-urate of Ammonia it contains. If Nitric acid be dropped upon a portion of the same Urine, it is reddened at



the point of contact and the halo is pale green, and if ammonia be now added, the halo is deepened and the color is permanent. In the first experiment there was a single reaction, in the latter, a double one; in the first, the roseate tinge was transitory, in the second, permanent and deepened by ammonia.

The coloring matter of the Urine has not hitherto been isolated for analysis, it is doubtless identical with that of the Blood.

The following experiment affords some evidence thereof. A portion of the fluid effused into the pericardium, slightly mixed with Blood, is allowed to stand for two days, the fibrine with some adhering coloring matter is now to be carefully removed, and the albuminous portion carefully decanted. Distilled water is now to be added to the red particles remaining in the vessel, until it assumes the color of Urine. On adding Liquor Potassae the fluid becomes light green and the color gradually disappears, - if Nitric Acid is carefully added to another portion thereof the roseate tinge is at once produced, but an added quantity renders the liquid colorless. This experiment is valuable as an approximate truth.



## ANALOGY BETWEEN THE COLORING MATTERS OF URINE BILE AND BLOOD.

*Vito-chemical* researches make an affinity between the coloring matter of these is almost a matter of certainty, and we know that Iron exists in the Bile. Whether the color of the Blood does or does not depend upon the Iron it contains, is yet a mooted point, the weight of authority inclines to the negative. Iron has never yet been detected in the Urine although cases are on record in which patients suffering under enlargement of the Liver and Spleen, voided blue Urine, for which I can only offer the following rationale, A portion of the Iron of the Bile was secreted with the Urine, where it probably passed through a series of combinations with the products of Urea in a state of transformation similar to that noted under the division, "Tests for Urea". one of which gave a precipitate of Prussian Blue. There is little doubt that further researches will establish the identity of the coloring matter in each of the above formations. One important fact remains to be noticed;—when the Kidneys secrete any particular principle in excess, they suffer it to pass unchanged, whereas the same principle



secreted in a much smaller quantity is generally eliminated into other compounds.

**URIC ACID.** A deposit of Uric Acid, known as the Latrigenous sediment occurs upon the subsidence of all low fevers.

Before the commencement of febrile action there is little or no excess of Uric Acid, in the prior stages, Urea is the only azotized substance in excess. We here find a valuable diagnostic fact. - At this stage of the fever, (cessation,) the Urine holds in solution a larger quantity of Uric Acid than an equivalent of boiling water could dissolve. Kersey supposed that this superior solubility of Uric Acid was caused by its combination with coloring matter; but Prout maintained that it is in combination with Ammonia with an excess of Acid, in the form of super-urate of Ammonia, I shall offer yet another view: - let us suppose that the oily matters in excess, (always found in these circumstances,) are combined with the urate of Ammonia, probably with some free Ammonia also, from which cause a larger quantity of Uric Acid passes through the kidneys than could otherwise occur. We shall hence have formed



an ammoniacal soap: and thus by a beautiful provision of Infinite Wisdom, the lining membrane of the bladder and urethra is protected from irritation, the very substances which would have acted as irritants, being thus rendered innocuous, Reagents readily separate the oily matter from its combinations as Sulphate of Iron, Ether &c.

## ORIGIN OF THE URIC ACID. *We have seen*

that Urea is the result of the transformation of Sitrine, Albumen &c. and I may now suggest that Uric Acid is the result of the decomposition of the red particles of the Blood. We know that in Typhus, the Blood is not effectively vitalised or in other words, that it is not combined with the normal proportion of oxygen, and in extreme cases it is incapable of so doing even by exposure to the atmosphere. This defect causes a necessary change in the composition of the Hematosine.

If normal venous blood is exposed to the atmosphere, it combines with its oxygen and is reddened, but after a second combination it is unaffected thereby, or if a portion of the coloring matter which has been kept beneath the serum for a few days, and never oxygen-



acid, be then exposed to the air, the usual changes are not induced; from these facts we may reason that the coloring matter has combined with an excess of carbonic acid and is thereby deprived of its distinctive characters. The same effects no doubt occur within the body. In the early stages of Typhus, the Blood acknowledges the influence of oxygen, in the more advanced ones it loses this property, and eventually but a small portion of it combines with the oxygen of the atmosphere. Now this fact stands out as the most important point in the *in-vitro*-chemistry of all low fevers, for if the coloring particles, (the carriers of oxygen according to Liebig) have lost the power of combination with oxygen, none of the functions dependent upon arterialisation of the Blood can be performed, and therefore chemical death in the Blood <sup>gradually</sup> ensues. But before health can be restored, these morbid particles must be eliminated from the system, and their elimination develops the Uric Acid and the oily and coloring matters always found in the Urine in Typhus. These principles would however be subject to certain modifications, if the Liver was in a normal condition, but when Uric Acid is in very large



excess in the Urine, hepatic derangement will always be found.

## FORMATION OF URIC ACID. The coloring matter of

the Blood is <sup>not</sup> identical with Fibrine, although more nearly related to it than is any other animal principle. According to Michaels, 1000 parts of the coloring matter of venous blood, yield the following products.

$\begin{matrix} \text{C} & \text{N} & \text{H} & \text{O} \\ 532.31 & 173.72 & 77.11 & 216.66 \end{matrix}$ 
 We thus reduce these numbers to equivalents,

1 atom of Carbon weighs 76.347 - of Nitrogen 177.04 - of Hydrogen

12.478 - of Oxygen - 100. Divide the number of parts by the atomic weights and we have

$\begin{matrix} \text{C} & \text{N} & \text{H} & \text{O} \\ 6.792 & .983 & 6.261 & 2.166 \end{matrix}$ 
 Now we reduce

these results to the nearest approximate whole numbers, thus, -

take 4 equivalents of coloring matter (adding to each one equiv. of Carbon

in excess to prevent arterialization) and we have

4 equivalents of Hematosine	28	4	25	9
4 " " Carbon added	4			
	32	4	25	9
4 equivalents { 1 equivalent of Uric Acid	10	4	4	6
{ 2 " " Oily Matter	22		20	2
{ 1 " " Water			1	1
	32	4	25	9

It is hence apparent that the morbid coloring matter of the Blood is readily transformable into the identical principles we found in the Urine at the precise period when we should rationally look



for them to be eliminated, that is, when the skin begins to look less livid and dusky, the eye brighter and the pulse firmer, or at the period of commencing reaction; and it is then only that an excess of uric acid is found in the Urine, whilst the amount eliminated will depend upon the intensity of the disease, and the extent of the departure of other organs from their normal condition. We added Carbon to the Blood instead of Carbonic Acid, for it is probable that the Carbonic Acid is decomposed in this disease, whereby the Carbon is fixed and the Oxygen liberated to form new combinations, and it is probable that such decompositions cause the non-oxidation of the venous Blood.

## THE GENERAL SYMPTOMS OF TYPHUS,

are a sense of coldness along the vertebrae, pain or weariness in the loins with head ache or stupor. Lassitude, weariness or muscular prostration, (although alone not diagnostic of Typhus,) yet afford us a valuable criterion in prognosis in its different stages, being always present and first demand my attention; for as the prostration is great or little, so will the prognosis be favorable or otherwise. At first there is only a disinclination for any muscular movements,



which in the more advanced stages is marked by inability to maintain the erect position, soon followed by unbroken recumbency, whilst lying; the knees are more or less flexed and the head is turned to one side, usually from the light. In this state the patient is conscious and to alleviate his realization of muscular fatigue, assumes the position most favorable for rest, the state of equilibrium of the muscular forces. The flexed position of the limbs assumed in sleep, permits the contractile force of each muscular fibre to balance its opponent without inducing consciousness, and when the forces are at their minimum; for upon the disturbance of this equilibrium, consciousness of effort to effect an increase of force is at once induced; this state is designated relaxation, a very fallacious term. One set of muscles may be in an active state as regards volition, and another set passive, but this condition would not be relaxation, a phrase more properly applied to that marked prostration accompanied by unconsciousness, so apparent in the last hours of the patient. In the passive state, each muscular fibre exerts only that degree of contractility called the



tone of the muscle, and which, with the whole muscular system, is just sufficient to support the bones and the soft parts, which are the natural resistance to the tone of the muscles.

During life the lower portion of each limb acts as a weight whereby the upper portion is drawn into a right line with it; thus the whole leg acts upon the hip-joint, and the fore-leg, upon the knee joint; when the patient is upon his back, if the muscular tone is deficient, a state of complete supination must ensue.

When the tone of the muscles is not greatly reduced, the patient will lay on the side with flexed limbs, the state of rest; but not of relaxation; and this position is retained only by the tone of the muscles, which, failing, the legs are extended, assisting in throwing the body on its broadest surface, the back, which is the true position of general relaxation, the body now obeying the law of gravity alone, we are hence assured that when this state exists, death is near at hand. The muscular condition may be divided into four distinctive stages;—1st. Defective Volition. 2d. Powerlessness. 3rd. The Passive Stage. 4th. Relax-



ation. Muscular relaxation is primarily caused by the change of conditions in the extreme texture and not by any disturbance of the nervous centres, for it will sometimes occur in the earlier stages, that nervous centres may be but little disturbed, while the muscular depression is considerable, indeed these two phenomena seldom have a direct relation to each other, for the affection of the brain and the spinal cord may be extreme, and the power becomes inconsiderable, and vice-versa; hence loss of muscular power must be dependent upon some change progressing in the substance of the muscle itself. The same fact is seen in an attack of Mucos-Enteritis, and affections much resembling Typhus, presenting the same prostration, although in Mucos-Enteritis there is little or no cerebral disturbance.

**MUSCULAR RELAXATION.** That stage of Typhus in which the muscular system is to the greatest extent influenced by the condition of the nervous centres is that of relaxation, the result of exhaustion of the brain, accompanying relaxation of the sphincters and dilation of the pupils. phenomena attributable to



the same cause. The Iris, from its superior susceptibility, is usually earlier affected than any other muscular organ, but as its cause is the same, it affords a valuable criterion of the state of the whole muscular system. There is no diagnostic so expressive of the power of the whole organism, as the state of the muscles. The symptoms indicating the most danger, are a dilated pupil, falling of the upper eyelid, subcultus tendinum, involuntary exertions and the supine condition, all expressive of extreme muscular relaxation, the effects of a morbid condition of the nervous centres, and the loss of nervous energy. These reflections naturally lead us to a review of the —

**GENERAL LESIONS IN TYPHUS** in which congestion and inflammation of the brain and its meninges are the most important pathological phenomena, and which are so generally recognised, as to render necessary only the peculiarities by which they may be contradistinguished. According to Louis, "the substance of the brain itself is generally the affected part, the medullary portion being injected in six sevenths of his cases, whilst the cortical substance presents



abnormal vascularity in only three sevenths." In rather more than half the cases observed by him, there was increased redness of the arachnoid and pia-mater, but the dura-mater was seldom implicated, and it is noticeable that the injection of the pia-mater and brain was greatest in those cases which soonest terminated fatally; whilst in those in which death was longest delayed, effusion was always found. Sometimes the brain was abnormally dense or soft, but as in this condition the whole organ was implicated, it was not the result of inflammation. The following statistics from Gallenard are valuable. In 46 cases of Cerebritis, 33 showed evidence of previous inflammation of the cortical structure, and only 8, of inflammation of the medullary portion:— in 16 cases the cortical structure covering the convolutions was principally affected, in 13, the corpora striata and optici thalami, and in 4 only the tubercular.

ARE THE CEREBRAL LESIONS CONGESTIVE OR INFLAMMATORY? In Cerebritis, the cortical structure



is affected, compared with the medullary, in the ratio of 4 to 1; in Typhus the proportions are reversed, and the medullary compared with the cortical, is affected in the ratio of 2 to 1. Now the question is pertinent, - Is the affection of the brain and its membranes, in Typhus, generally of an inflammatory character? We reply, it is not. The distinctions are well marked between acute Cerebritis and the cerebral sensation of Typhus. In Cerebritis, the injection is limited to definite spots, in Typhus it is general: in Cerebritis the adjacent parts are abnormally denser or softer, with occasional serous or purulent infiltration and apoplectic spots. - These lesions are rarely found in Typhus: in Cerebritis the diffused fluid is usually opaque, in Typhus it is almost always transparent. From these facts we conclude that the cerebral lesions in Typhus are congestive. The effusion autopsically found, is alone no evidence of previous inflammation, for it is known that towards the termination of many diseases, the serous and mucous surfaces exhale fluids, and sometimes in enormous quantity; the skin also does the same, and in Typhus on the approach of



death, its exhalation not uncommonly becomes very profuse and offensive. Effusion into the ventricles of the brain, or between its membranes is most common in cases which have lingered along for some time, and this fact evidences that the effusion is passive - the result of want of tone of the secreting vessels. Upon this point, observation and vito-chemical researches are in agreement. Inflammation of the brain or its membranes is sometimes found in typhus but only at its commencement, but in the great majority of cases, congestion alone is found from the beginning of the attack, and in fatal cases, the evidences of general congestion and effusion are indisputable. In inflammation of the membranes the pain is more intense and lancinating, with a sense of weight and fullness at the top of the head, the eyes are suffused and averted from the light, there is intolerance of sound, great pyrexia and exaltation of the senses. In congestion, the external senses are only slightly affected, becoming less impenetrable as the disease advances, and the fever throughout is lower in mode. The



neurilema of the nerves of sense is probably affected in inflammation of the brain, but is intact in congestion: - the eye is a good diagnostic of these several cerebral conditions: in congestion it is dull and hazy, the pupil sluggish, this is the usual aspect in Typhus. This dull appearance is sometimes succeeded by a clear glistening brightness, which must not be confounded with the suffused, injected eye of inflammation; it is on the contrary, symptomatic of hectic, and pathognomonic of suppuration of the glands of the ileum. The hectic stage of Typhus is barely noticed by authors, but where necessary pathological conditions exist, it is as definitely marked as in Phthisis. It indicates suppuration of the glands of the lungs, the abdominal glands, or both: but these points will be more fully considered hereafter; I have only noticed them in demonstration of the eye as a diagnostic. The clear glassy eye in Typhus, is too often mistaken for the harbinger of returning health, and its delusive promises receive apparent confirmation from the clear red tongue and flushed cheek accompanying it, whilst in fact these are but the indications of extensive disease of the glands and mucous surfaces.



## MECHANICAL CAUSES OF CONGESTION AND EFFUSION.

We have already shown that actual inflammation of the brain and membranes is comparatively rare in Typhus, but that congestion exists in every case, nor should it surprise us that the brain is congested and the pia-mater loaded with blood, it would be more surprising if such was not the case, when every other organ is in that condition. Congestion is the effect, never the cause of disease, and seldom demands medical interference. Many of the symptoms and post-mortem appearances in Typhus, are directly induced by mechanical causes. The brain, in common with every other fatty and albuminous portion of the organism, is subject to rapid waste in this disease, and from the non-yielding structure of the cranium, the diminution of the volume of the brain causes a vacuum between its membranes, which alone would cause pain and a sense of weight, besides attracting enough blood to fill the increased space. Either congestion must be thus induced, or a fluid must be effused to maintain the integrity of the mechanical forces, and to prevent undue pressure of the cerebral organ, hence disturbance of the brain is seen in every case of Typhus. When the brain diminishes much in volume, as in aged people, or during rapid emaciation from



fever, we may always predicate congestion or effusion. These views explain many of the difficulties usually present in diseases of the brain, and which have hitherto been little, if at all understood.

**STATE OF THE LUNGS.** A true knowledge of the state of the lungs in Typhus is of practical importance, for although they do not during the fever develop any very prominent local symptoms, yet it is certain that the case is retarded or aggravated in proportion to their congestion, while their varied affections present some of the most important sequelae of the disease. During the progress of the fever congestion of the lungs is a constant symptom, commonly accompanied by Bronchitis of a sub-acute character: the congestion may develop Pneumonia, or it may call into activity a dormant scrofulous diathesis, and develop Phthisis; indeed such predisposition, when present, will at least render the case more intractable, if not fatal, and the more so if there be added thereto acute gastro-enteritic symptoms.

The autopsical appearances are congestion and inflammation and their results, induration and infiltration either serous or purulent, and occasionally the usual symptoms of Phthisis are manifested.



Every organ is under morbid influence during Typhus, and indeed in every other febrile modification, and the risks induced thereby may be thus stated:- during the fever, lesions of the liver are to be most feared, and affections of the lungs in the convalescent stage, but lesions of the digestive apparatus demand attention through every stage of the disease, and until the full restoration of the normal or health condition. The Spleen is always in a state of softening and this is not always caused by inflammation, but cases are on record in which abscess was found on that viscus, in connection with inflammation of the serous covering of the Diaphragm. The liver is generally congested and sometimes inflammation supervenes, and softening thereof is of frequent occurrence.

## STATE OF THE LYMPHATIC SYSTEM.

Those components of the digestive system whose lesions are the most characteristic of Typhus, are the glandular organs of the intestines and the general lymphatics. Every other organ appears at first to be only congested, but the sequelae will depend upon the intensity of the fever and the idiosyncrasy of the patient, but the glandular system suffers from the first, by the action of



the virus passing through a series of changes which maintain and aggravate the constitutional disturbance. From the very general implication of the glands of the gastro intestinal surface, Brucet created his theory of the cause of Typhus; but he was in error in limiting the pathology of Typhus to these glands, as they only a part of the system designed to prepare the food for the purpose of nutrition; and although they may not be diseased, the system of which they form a part, is always so.

## IDENTITY OF FUNCTION OF THE ABDOMINAL AND GENERAL LYMPHATIC SYSTEMS.

That the mesenteric glands, the lymphatic glands, and the glands of the intestinal mucous surface perform the same functions, may not at first thought be apparent, but physiology and chemistry both sanction and confirm the assertion. In mesenteric disease, induration and suppuration of the glands of the intestines are commonly present, indeed it is probable that in the last stages of the disease, these glands are always involved. Autopsical observations attest that when death has occurred from mesenteric disease, the glands of the



mucous-intestinal surface are always diseased, and sometimes primary indurations thereof were perceptible beneath the transparent mucous membrane showing that it was only secondarily affected. It is already admitted that simple mesenteric disease is never fatal, but that death is induced by disease of the mucous surface of the intestines and glands, and in Phthisis, disease of the mesenteric glands and the glands of the ileum are almost in every case coexistent.

## STATE OF THE LYMPHATIC SYSTEM IN TYPHUS.

In Typhus, the two lesions almost always coexist, although inflammation, softening, or suppuration of the glands of the ileum may not always be apparent, yet disease of the mesenteric glands is nearly always cognisable, a position affirmed by careful observers in all lands. That the general absorbent system is always either functionally or structurally diseased, in Typhus, is proved by the rapid emaciation of the body, as also by those affections of the glands so often presenting as sequelæ. Although disease of the ileo-intestinal canal is marked by symptoms of greater gravity than of the mesenteric, owing to their nearness to the mucous surface, yet it is not more pathognomonic



of Typhus, nor are either of more importance than the general affection of the absorbent system. Hence the theory of Broussais was defective both in fact and inference, in fact, by the partial and delusive dogma, "that lesion of the ileo-intestinal glands was the only pathological condition essential to Typhus," whereas the mesenteric glands are more frequently diseased: and in inference, that the fever was only irritation, or secondary to the local affection, when the glands of the mucous surface are suppurating, the delicate plexus of vessels and absorbents in the mesentery, (within about a quarter of an inch of its duplicature ~~it~~ encloses the intestine,) is largely injected and the absorbents are of a dull white color, being filled with purulent matter. The lacteals pass on to the mesenteric glands, furnishing a continuous chain of inflammatory action. The inflammation of the lacteals is identical with that induced by the application of a poison to the skin, nor does it matter how it is taken up, for its effect upon the system is under all circumstances the same. Thus Tartar



Emetic injected into the veins produces vomiting. Mercury rubbed into the skin causes salivation, and, Strychnia applied to an abraded surface produces death as certainly as though taken into the stomach, in short, every poison introduced into the system has a determined action thereon, hence the virus of Typhus however introduced, exercises its specific catalytic influence on the absorbent lymphatic system. The consequence of this condition of the lacteals is anorexia, and loss of power of the digestive organs:—to remedy which, the systemic absorbents commence taking up the fatty matter found in the cells of the adipose tissues, but these principles not passing through the requisite changes, soon occasion inflammation therein. This increased activity of the systemic absorbents is one of the most marked phenomena in Typhus, arising from the demand made upon the unorganized mass of matter of the system, to supply the waste rapidly progressing in the extreme textures. It is probable that the whole absorbent system is rendered morbidly active by the



virus, and that the increased action of the systemic absorbents, is not entirely secondary to the affection of the abdominal glands; for, in the Plague, a disease much like Typhus, the inflammation of the absorbents is the pathognomonic symptom. The black death also was marked by the evolution of tubercles, or abscesses of the lymphatic glands of the general system. A full consideration of the viro-chemical conditions of the absorbent systems, in various diseases, will furnish full evidence that the lacteals and lymphatics perform the same office. To wit: - the preparation of food for the purposes of Nutrition. Hunter supposed that the lymphatics absorbed the waste matter of the system; whilst Magendie denies that the absorbents, so called, possess the power of absorption; - Müller maintains that they receive the liquor sanguinis direct from the capillaries, a view opposed to their absorbent action. Müller's theory was based upon the qualities of the fluids found in the lymphatics, but he failed to notice the proportions their constituents bear to each other. We cannot obtain a true knowledge of the pathology of any disease,



without full knowledge of the normal state of the parts involved; hence it is necessary that we should ascertain the peculiar properties of the fluids in the absorbent vessels.

## IDENTITY OF FUNCTION OF THE WHOLE LYMPHATIC SYSTEM PROVED PHYSIOLOGICALLY.

We have asserted that the functions of the lymphatics are identical with those of the lacteals. - that they do not take up waste matter or the effete particles of the body, and that they are not merely the vehicles of the colorless liquor sanguinis. It is evident that the glands through which the absorbents pass, assist in the preparation of food for nutrition, in the same manner as the mesenteric glands of the abdomen, in short, that the lacteals and the lymphatics with their glands, form one complete digestive system. An examination of the relative proportions of the fluids they severally contain, will impel us to this conclusion.

## CHEMICAL CONSTITUTION OF LYMPH.

City matters, albumen and salts are the principles found in excess in healthy lymph. If we compare the proportions of each of these principles in the blood and lymph, their wide difference is at once apparent. According to



Thus 1000 parts of blood contain on an average, 1.65 of crystallisable fatty matter, and 1.15 of oily matter, being less than 3 parts in the 1000. Of all the constituents of the blood, fibrine possesses relatively, the greatest amount of oily matter, which according to Chevreul, is from 4 to 5 per cent. Marchand and Colberg in their analysis of lymph, found only 2.65 parts of oily and fatty matters in the 1000, about  $\frac{1}{8}$  less than exists in an equivalent amount of blood: but if the aqueous particles are deducted, and the relative proportions of the oily principles compared with the residual solid contents, be ascertained, a great difference is apparent.

AMOUNT OF SOLID MATTERS IN BLOOD AND LYMPH RESPECTIVELY. Prevost and Dumas obtained from 1000 parts of blood 129.36 of coagulum, which, compared to the oily matters is as 43 to 1. 1000 parts of lymph contain 5.20 parts of fibrine which compared with the oily matters is only as 2 to 1. It is thus seen that there are 43 times more fibrine in the blood than oily matter, and only twice as much in the lymph, showing conclusively a large relative excess of oily matters in the lymph as compared with blood. The same chemists found in 1000 parts of blood,



86.90 of albumen, whilst Marchand and Golberg found only 4.34 parts of that principle in 1000 of lymph. We find therefore, that lymph contains in the same amount of solid ingredients, twice as much albumen, and twenty-one times as much oily matter as the blood. There is evidence of intelligent design in this marked disposition of the organic principles in the lymphatic vessels, showing that they are not mere organs of transit for the colorless liquor sanguinis, and that they do not take up the effete matters of the system, but that they are truly and efficiently, digestive organs: that in them the oily matters pass through important changes, being converted into albumen, and this again into fibrine. The oily matters may be deemed the principles of nutrition, for with the exception of the fibrine and albumen taken into the system already formed, it is well known that all the other principles are compounds of starch, which before assimilation, is converted into oily matters. Now in the same manner as the lacteals digest the oily matter formed from the starch contained in the food, so do the lymphatics digest the oily matters absorbed from the system. The adipose system is a



magazine of foods of which the lymphatics are the digestive apparatus.

The analogy between the lacteals and the lymphatics as to their contents, is equally significant, oily matters being in great excess in the latter, and in the former, fibrine does not appear until they have received the lymph from the spleen, and through the mesenteric glands. the conversion of oily matters into azotized principles cannot be maintained unless there be a sufficient supply of said principles from the blood, hence the absorbent and mesenteric glands are abundantly supplied with arterial blood, and as all these glands are devoid of ducts, must we not necessarily conclude that they all fulfill the same office in the economy?

**ASSIMILATION IN HYBERNATING ANIMALS.** In the phenomena of hibernation, additional proof is found of the position we have assumed, for when animals seclude themselves for their Winter's sleep, their adipose tissue is loaded with fat, which on their return to normal life in the Spring, has been wholly consumed. Whence the disappearance of the fat? Liebig assumes that it has been consumed in the process of respiration, but if that is true, what



furnished subsistence during the normal state? and whence is the waste replaced, so that life may be maintained? It is known that bile and urine are secreted during the dormant state, and their secretion is consequent upon the disintegrating action progressing in the extreme texture. Now it must be evident that these processes could not be maintained, however slowly, for any length of time, without inducing disease or death, unless new increments of azotized principles were continually supplied to the system, respiration alone could not sustain life, it would rather hasten its termination; but, recognizing the conversion of fatty matter into Albumen, we can at once see how the chemical and vital functions are sustained. Marshall cites the case of a pig which was accidentally buried underground sixty days, during which time it lost 150 lbs. in weight. Is it not incontrovertible that in this case the loss of weight and the maintenance of life were inseparable? In asserting therefore, that when circumstances demand it, an animal lives upon itself, is claiming no more than has been partially admitted; but it is important



that demonstration should take the place of admission, and to this end, we must understand the mode of assimilation, by a knowledge of the organs which effect the necessary changes.

### CHANGE OF OILY MATTER INTO ALBUMEN IN THE EGG.

The transformation of oily matter into albumen in the egg is fraught with instruction. At first the amount of the white (Albumen) is small, and the yolk large. The yolk contains a large quantity of oily matters in combination with the albumen, but gradually the white is much increased in amount, and that increase is relative to the decrease of the fatty principles. Here also, oily matters are converted into albumen; but what is the mode of change? As the albumen forms, a space is left at the large end of the egg owing to the disappearance of watery particles, and this is filled with atmospheric air, but there is a disproportion in its elements, for Dulk and Bischoff found it to contain an excess of 4 per cent. of oxygen. Whence this excess? We answer, the Nitrogen was absorbed in the process of the conversion of the oily matters into albumen, for from no other source could the particles have become azotized.



## THE SAME CHANGE EFFECTED IN THE HUMAN SYSTEM.

In illustration of the conversion of oily matters into azotized principles, we refer again to the formula already introduced, showing that by the addition of Uric Acid to oily matter, we obtained the equivalents of the red particles.

If we further add to three equivalents of oily matter, one and a half equivalents of Uric Acid, we obtain Protein, Fibrine, or Albumen; thus—

	C	H	N	O
3 equivalents of Oily Matter	33	34	30	3
1½ " " " Uric Acid	15	6	6	9
	<hr/> 48	<hr/> 6	<hr/> 36	<hr/> 12

forming one equivalent of Protein minus two atoms of oxygen. It hence appears that Uric Acid or its elements is a most important agent in the assimilation of oily matters which form the bases of certain parts of our food, and it is almost beyond doubt that these changes are effected chiefly, if not wholly, in the lymphatic system, thus combining the lacteals and external lymphatics with their respective glands, further, this view of their function accounts for the large quantity of arterial blood supplied to them; and further, it indicates that all those glandular structures which have no efferential ducts, perform the same function. This elimination of Uric Acid, and its combinations with oily matters, must not be confounded



with the general formation of Uric Acid in the extreme textures: not  
but that the same changes may to a limited extent, occur in the  
circulating mass; but the conversion of oily matters into allamen  
is so gradual a process, that in the circulating mass this change  
bears no proportion to its true and proper office of uniting with  
Oxygen to form Water and Carbonic Acid in the evolution of heat.  
Proust has shown that after a full meal of oily matter, the Urine con-  
tains an unusual amount of Uric Acid, which Liebig explains on the  
supposition that the oily matter combines with a larger proportion of Oxy-  
gen, and withdraws such increased portion from the quantity neces-  
sary for the maintenance of the normal action of the extreme textures,  
the result is the formation of Uric Acid, which no doubt is generally the  
case. The Uric Acid formed in the extreme textures is properly a  
substance for excretion, for the oily matters with which it comes in con-  
tact in the circulation, have a greater affinity for Oxygen than for it,  
and hence these changes for the purpose of nutrition, which we  
have predicated upon the lymphatics, do not occur in any appre-  
ciable degree; but we may not consider Uric Acid or its elements as



a mere excretion, for it is a most important and essential  
egotizing agent in herbivorous and carnivorous life. We have been  
thus full in our views of the function of the lymphatic system,  
that the pathology of Typhus may be fully demonstrated, for  
it is useless to attempt the comprehension of the pathology of  
any disease, unless we fully understand the indications presented  
by the physiology of the organs implicated. The function of the  
absorbents is dependent upon the condition of the blood. In the period  
of increased action in the early stage of Typhus, the coagulum of the  
blood is greater in quantity, firm, and tenacious; at a later period,  
the salines, and aqueous particles are much diminished, whilst  
the coloring particles are almost black, and are frequently  
precipitated. As the fatal termination approaches, the coag-  
ulum is very small, the blood is a greenish black, soft,  
barry looking mass. Let us ascertain what relation these  
facts bear to the action of the lymphatics. It is probable  
that in the first, or increasing stage, a considerable por-  
tion of the fatty matter supplied by the vigorous action of



the lymphatics, combines with the Uric Acid to form fibrine; as the disease advances, the functions of the absorbents is suspended, and the fatty matters are no longer digested, but pass off with the Urea, so largely increased in amount. In the later stages, inflammation and suppuration ensue, and constitute the pathology of Typhus.

DIAGNOSIS OF PETECHIÆ. Severe cases of Typhus often are characterized by an hemorrhagic tendency, and the organs most commonly affected are the skin, the lungs and the bowels. Petechiæ differ much in aspect, but it is needless to distinguish more than three varieties. In the first, they are of a bright red color, of the size of a pin's head, and are often mistaken for the bites of fleas or mosquitoes, from which they are however distinguished by the absence of a central dot and circumferential areola, they commonly occur about the fourth day, and usually on the neck and breast. If the fever is not very severe, they retain their color during its continuance, but a change from a bright red to a livid or dusky hue, is unfavorable, and the more sudden the change, the



more alarming the indication. Petechiae of a bright red color do not warrant an unfavorable prognosis, but when they assume the livid tint, there is little hope for the patient. In the third kind, the Petechiae are known as *Vibices*, they are of large size, livid or greenish black, and are always unfavorable. In diseases of excessive violence as the Plague, they appear almost simultaneously with the attack; and this remark applies in extremely malignant cases of *Typhus*; usually however, they do not appear until a short time before death of which they are the precursor.

**HÆMORRHAGES**, particularly from the bowels, are frequent in fatal cases, and the quantity of dark decomposed blood sometimes poured out from the mucous membrane is astonishing. A case is on record of a young woman 16 years of age, from whose bowels three large urinals of blood was poured out previous to death.

**HÆMOPTYSIS** sometimes occurs in *Typhus*, and may be attributed to the same cause as when from any other organ *viz.* - decomposition of the blood and loss of tone of the capillaries. To this, some cases are more predisposed than others; and certain forms of *Typhus* induce an increased



tendency thereto, as under other forms. Petechiæ &c. are more frequently manifested. We hence learn that in this, as in other diseases, we have yet much to learn.

THE PETECHIAL ERUPTION. So much attention has been paid to this eruption as a diagnostic, that we are induced to give it further consideration. It has been said that this symptom is the true pathognomonic characteristic of Typhus, attending it as uniformly as the eruption of Rubella or Scarlatina. Chomel and Louis are of this opinion, making it the line of demarcation between this and other continued fevers, and further maintain that the Petechiæ are renewed every fourth day. It cannot be denied that Petechiæ are often present in Typhus, but the commencement of their appearance differs largely in different epidemics and at different seasons. In the epidemic in London in 1838, this eruption was seen in almost every case, while in other epidemics it is so infrequent as to excite little if any attention, while in all other respects the closest observation fails to detect any other difference in the disease. It is evident that past observers have erred in determining



the relation of the petechial eruption, by observations made at some special season or during some particular epidemic, an error which has found apparent confirmation from the impressions of the observer, inducing him to call nothing Typhus, in which the eruption was not recognizable. We cannot admit this eruption to be an essential characteristic of Typhus, yet its appearance furnishes us with an added diagnostic; and the periods it observes in its appearances and remissions, aid us in the elucidation of its pathology. The eruption, (in its early stages disappears under pressure of the finger,) fades away and is replaced by a new crop every fourth day, indicating thereby an intermittent action of the vessels of the cutis, and in this respect, assimilating Typhus to the regular eruptive fevers.

THE EXCITING CAUSE OF TYPHUS. Having developed the structural and chemical pathology of Typhus, and noticed some of its most distinctive symptoms, we now propose to investigate the ultimate producing cause of the disease. We have already shown the proximate chemical cause, nothing now remains but to discuss the ultimate



exciting causes. The producing cause is the same as that which propagates it, hence this position involves the question of its infectious or contagious character. We define contagion, thus; - the transmission of disease by external contact: infection; - its diffusion by the imbibition of some morbid exhalation suspended in the atmosphere.

There are four modes whereby a poison may affect the system: 1st. By absorption through the skin, 2d. By inhalation. 3d By the stomach. 4th By the application of active principles to an abraded surface, whereby it is placed in immediate contact with the capillaries of the blood vessels and the absorbents, and also by direct injection into the blood vessels. An examination of these several modes will enable us to determine how, in any case, the morbid agent obtained access to the organism, as well as the nature of the cause itself: for we cannot determine the fact of a patient having received the infection through the lungs, unless he has been exposed to some miasm; nor by the stomach, unless the active cause has been presented thereto.

THE CONDITIONS AND PROOFS OF CONTAGION. *Review of the*



absorption of the virus of Typhus by the lungs and skin presents some important queries. to wit:— Is the disease propagated chiefly or wholly by contact, by the influence of a miasm, or both? I am not aware that any authoritative writer has attempted to disprove the contagious nature of Typhus, and the number of well attested cases which have been noted, must certainly be admitted in proof of its contagious character. That Typhus is also communicated by infection, is a fact which cannot be disproven. The following cases which occurred in the year 1843 are of sufficient interest in this connection to be quoted. A young man aged 18 was brought home sick, his disease proved to be Typhus and presented the usual characteristic symptoms. During the progress of the fever, the family, (consisting of nine persons,) were not affected, but in the stage of reaction, which was accompanied by profuse perspiration, the whole family became affected, with but two exceptions, the first, a boy who slept away from home but took his meals there, and the father, an old man, who although he escaped Typhus, had a febrile attack of a severe character. The deductions drawn from these facts are valuable;— 1st. The young man was first affected by causes develop-



ed within his own system, probably owing to some peculiar atmospheric conditions, for no source of contagion could be traced, nor was any irregularity of diet or habits of intemperance admitted. 2d. The immunity of the whole family until the stage of reaction, with its attendant copious perspiration, when the whole family who were at night exposed thereto, excepting the old man, whose very age modified the influence of the exciting cause. 3rd. The immunity of the boy, who although eating at home, slept elsewhere. 4th. The diet was not the agent in the propagation of the fever, for the boy who sat at the same table, and ate from the same dishes as those who fell under the disease, escaped. Here then we must conclude that the family took the disease by infection; - the mode; - the inhalation of the morbid miasm thrown off in the perspiration and suspended in the atmosphere. Nor was the infection the result of general atmospheric causes, for not a single case occurred out of that house, although the neighborhood was closely built up and densely populated. The fact of the son, who slept from home, escaping the disease is evidence that Typhus is taken into the system during the night, when the



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vital powers are at their minimum, and the resistance of the system is at its lowest point. Nor was the family affected during the progress of the fever, nor when at its height, but, in the stage of reaction, a fact corroborative of the position before advanced, that in all cases of infection by inhalation, the period to be dreaded; - and in which the extension of the disease is most to be feared, is that in which the virus of the disease is being thrown off by the skin. Before the stage of reaction; - the skin is much like that of a mummy, not that there is not prior to this stage, a peculiar factor always present, arising alike from its surface, and the air expired; but it does not compare with the intolerable exhalation given off, during the profuse perspiration accompanying reaction. We hence learn that the danger of infection is small during the active progress of typhus, a fact, which if earlier recognized, would have saved much discussion and <sup>mis</sup> apprehension. The period of infection being that of reaction, (convalescence,) also explains another apparent difficulty. A severe case of Typhus had been closely watched from 4 to 6 weeks during its progressive stages, and as none of the attendants took



the fever, up to the time of convalescence, the opinion was expressed that the disease was not communicated. But within <sup>afterwards</sup> ~~ten days~~, some of the attendants presented the unmistakable symptoms of Typhus; in all such cases, the causes of the attack have been sought for everywhere but at the right point. In the case of the family cited, the infection was almost immediate, for to that end were all the surroundings favorable, but where cleanliness prevails, and the sick room is constantly and efficiently ventilated, the morbid exhalation is so diluted, as to require a much longer time for it to produce its effects upon the system.

#### THE NATURE OF THE VIRUS, PHYSIOLOGICALLY CONSIDERED.

Convinced that Typhus is a contagious disease and that its communicative power becomes developed during the stage of reaction, it becomes of interest to ascertain the nature of the exhaled virus. Is it a specific vital secretion, or the product of chemical action? Can malaria produce disease? if so, what analogy does it bear to the blood in any specific disease so produced? We have evidenced that the virus of epidemic diseases is specific, the result of definite changes progressing in the



living system. How then can dead animal or vegetable matter evolve a principle identical with the vital product? It is indisputable that none of the products of putrefaction are capable of inducing that series of changes in the living organism which we call fever; on the contrary, their effect, whether in large or small doses, is immediate, terminating within a period proportionate to the volume and intensity of the poisonous exhalations inhaled. Cases are on record, where the contents of an abdominal abscess underwent decomposition within a few days after the first incision, and when the fluid, which was very large in quantity, was occasionally discharged, the stench was unbearable even by the operator; this condition of the fluid continued for a considerable time, yet the health of the patient was gradually restored. It may be replied, that although the products of decomposition cannot produce fever, yet the emanations from putrefactive matter in the transition state, may possess that property. The objection is plausible, but before its truth is admitted, it must be demonstrated that putrefactive matter in the



transition state, possesses the same constitution as the virus in the living system. I do not assert that such matter cannot cause fever, but to do so, it must come into contact with some lesion whereby it can gain direct entrance into the circulation, a result seldom possible, and not entitled as a source of disease, to be considered a general law.

#### EVIDENCE THAT MALARIA IS NOT THE CAUSE OF TYPHUS

We shall under this section, carefully cite the evidence derived from experiment and observation. The dogma has long prevailed that Malaria are in most instances the cause of Epidemics: and that Typhus, when it assumes the epidemic form, is the result of malarious exhalations. In accordance with this dogma the reports of "Boards of Health," and of "Sanitary Commissions," are formed. Fever prevails in a given house, locality or district, and in that neighborhood a dung-hill, or a foul open sewer exists; consequently the fever was caused by the manure heap, the sewer, or by both. But such reports are always vague, and often present a mass of evidence directly opposed to the conclusions which their authors labored to establish. That Typhus



or any other continued fever does not depend upon Koino-miasmata or Malaria, is the distinct avowal of Dr. Barrow Howard, who in concluding a report made to the "English Poor Law Commissioners" to be laid before the House of Commons, says. - "It is my deliberate opinion that the vitiation of the atmosphere by the living is much more injurious to the constitution, and much more prolific of disease, than its impregnation with the products of decaying organic matter. and all I have observed in the principal towns and villages, imperatively drives me to the conclusion, that the human miasms generated in over crowded and poorly ventilated dwellings, are a far more efficient cause of fevers of an infectious nature, than the malaria arising from the most offensive collections of garbage and insufficient sewerage. In support of this opinion I may add that malignant fevers have more generally prevailed in neighborhoods where the dwellings have been small, over crowded and badly ventilated, although the streets in which they were situated, have been well paved, drained and more free from refuse, than in



neighborhoods where the houses were more thinly occupied, notwithstanding they were surrounded with nuisances giving rise to Malaria." These observations and conclusions are of much value in determining the innocuousness of malaria generated by dead organic matter; but they do not furnish proof that the mere products of normal respiration can produce fevers. I may remark en passant, that Dr. Howard appears to have overlooked the wretched circumstances, the many privations, the scantiness and poor quality of the food, and the very general habits of intemperance of the occupants of those "overcrowded and badly ventilated dwellings." I must maintain that putrescent emanations cannot cause Typhus, or any other continued fever. In corroboration of this assertion I quote the following from P. Duchatelet: At Montfaucon there is a general reservoir of all kinds of filth, and it was to be supposed that if the effluvia of putrefactive bodies possessed the power of producing infectious diseases, an unusual amount of fever in its worst forms should be found in this vicinity. This VOIRÉE



presents a surface of 32,800 yards and receives annually from 230 to 280 cubic yards of the product of the "fosse d'aisances", besides which accumulations, the bodies of 12,000 horses and of 25,000 smaller animals are allowed to rot upon its surface. Can the most fertile mind imagine circumstances more favorable for the development of febrile diseases than are here presented, if the exhalations of filth and decomposing animal and vegetable matter ever possess that power? The stench thereof is described as being of the most repulsive character, intolerable within a circumference of 2,000 yards, and sometimes including an area of 4,000 yards in its intense effluvia;— whilst some particular winds under certain conditions of the atmosphere, have been known to carry it eight miles. A description of the processes through which these materials pass to prepare them for the market, and the aggravating attendants surrounding those employed therein, is foreign to my purpose, it is sufficient for us to know that "Voivre d'Montfaucon" contains a concentration of every conceivable nauseating and disgusting putrefactive odor. What then is the health of the persons



inhabiting this neighborhood? most of whom are constantly enveloped in its offensive exhalations. Are they wan, haggard and emaciated? subject to fevers and premature decay? Directly the opposite! They are remarkably healthy, active and vigorous, many of them attain great longevity, and Typhus or other malignant fevers are seldom known among them. Nor do these remarks apply only to the ~~acclimated~~, fresh workmen who arrive almost daily, suffer no further inconvenience than nausea for a few days. Buchatelet further says: - "upwards of 200 exhumations are annually made in a single Parisian cemetery, and although the bodies are removed in every stage of decomposition, not a single case of Typhus has ever been known to occur amongst the men employed thereat. Before this overwhelming mass of evidence, the trivial and isolated observations upon which the old dogmas of the "malarial cause of Typhus" rests, must pass away.

THE EFFECT OF THE INJECTION OF PUTRID  
MATTER INTO THE VEINS. Although we think we have



demonstrated that emanations from putrefactive bodies cannot produce disease where the lungs are healthy, yet it does not follow that this matter cannot in any mode operate upon the system.

M. Gaspard experimented upon a dog by injecting fermented cabbage into the jugular veins. the animal died on the fifth day. He presented before death, all the symptoms of Typhus, and the autopsical appearances exactly corresponded with the symptoms.

The duodenum, rectum, and small intestines were inflamed; the mucous glands of the rectum were swollen and very distinct, the mesenteric glands were gorged with blood and inflamed, and black, thick, ropy tar-like bile was found in the gall bladder.

This single experiment demonstrates the production of Typhus by the injection of putrid matters into the veins, and it also proves that the action of the poison was expended upon the glandular system.

PUTRID MATTER INTRODUCED INTO THE STOMACH

A CAUSE OF TYPHUS. We now enter upon a branch of our

subject NEW so far as direct observations and experiments are concerned, but fraught with interest and importance. The causes of Typhus have hitherto been sought for



in the atmosphere, without once supposing that they could exist in the stomach. Overlooking the effects of decomposing matter in that organ they have sought with a zeal worthy of a better cause, for the presumed influence of its emanations. Privation has by some writers been deemed the main exciting cause of Typhus, and indirectly it is, for privation, and bad or poor food are inseparable. In proof of the truth of the assertion at the head of this section, I cite the following from the "British and Foreign Quarterly Review" (1843) "Between 5 and 600 persons assembled at a musical festival held at the church of Andelfingen, where, having spent four hours, they withdrew to a temporary outhouse where they dined on cold veal, ham, and salad with indifferent wine and beer. The meat did not look good and the ham had strange tastes that many did not partake of it, though most made a hearty meal. Four hundred and fifty of these persons were attacked with disease between the 1st (the day of the festival) and the 20th, of whom a large number died with marked typhoid symptoms, many on their way home vomited freely and afterwards suffered but little inconvenience, others were attacked between the 5th and 10th days, with nausea, vomiting, diarrhoea, pains in the



limbs and head, rigors, loss of appetite, great thirst, and a very unpleasant coppery taste in the mouth. About the 7th day (of the fever) the epigastric region became extremely tender, and the bowels were constipated; in some cases diarrhoea came on at this period, and the stools were dark green and highly offensive. Delirium accompanied this stage and all the typhoid symptoms were fully developed. Between the 14th and 17th days, slight cough with expectoration ensued, and the patient eventually convalesced. In fatal cases the typhoid symptoms rapidly increased, the abdomen became tympanitic, the stools horribly offensive and mixed with dark blood; great prostration, and death closed the scene. The autopsical appearances were, — congestion of the membranes of the brain, sero sanguinous infiltration of the lungs, redness of the lower portion of the external coat of the ileum, which, being laid open, presented dark red patches (very friable) on the mucous membrane, and in more advanced cases, patches of ulceration varying in size from a mustard seed to a five cent piece. There can be no room for doubt that these were veritable cases of Typhus (with the exception of those whose symptoms were of a choleric character.) The symptoms and post-mortem appearances are fully decisive on that point, and they are <sup>as</sup> fully



confirmatory of the production of Typhus by unwholesome food, as the "Voire d'Montfaucon" is of the non-infectious nature of the emanations of putrescent matter, and there can be no doubt that every sporadic case has its origin in the food taken by the patient.

THE EFFECTS OF PUTRID ANIMAL MATTER TAKEN INTO THE STOMACH. A rabbit, the animal of all others in whom vomiting is least easily excited, was fed on putrid lung for ~~two~~ days, giving it a little each night and morning with a sufficiency of water, and a small quantity of bran. No particular symptoms beyond stupor, were induced, there was no diarrhoea yet the animal died in 36 hours after the first meal.

POST-MORTEM. The stomach contained much semi digested matter, which, on being removed, was covered with a chymous coat (or probably epithelium) which had disappeared in many places from the surface, especially towards the fundus, but there was no unusual redness of that organ: - the jejunum was healthy, but slightly injected; - the ileum was diseased on its anterior surface over its whole extent, its glands were softened and enlarged, and of a greyish white tinge, - the mucous membrane between them was highly injected, and of a livid, red color, and covered with pus. The adjacent absorbents were



filled with pus. Three mesenteric glands cut through near the junction of the ileum and caecum were of a purplish red color, soft in the centre, with a wall of a white color about a line in thickness; - when these were pressed with a scalpel, pus extruded. Another contiguous gland was of a purplish red color, without the white wall, and did not contain pus; it was firm with a white vessel running through it, this gland was only inflamed. The gall bladder was filled with aropy, greenish-black, tar-like bile; the colon was distended with faecal matter possessing little odor. Now these are the precise pathological symptoms of Typhus, and there can be no question upon the character of the disease induced, if pathological researches are worthy of credence.

ANALOGY BETWEEN TYPHUS AND SCARLATINA. It has been noticed that Scarlatina has been induced by the consumption of putrid food. We are satisfied of the fact, and are of opinion that the differences of their development are produced by some constitutional peculiarity, aided maybe, by some certain specific conditions of the atmosphere. Typhus and Scarlatina when epidemic, always prevail together, or at periods succeeding each other at short intervals. Scarlatina generally following Typhus. This is not a casual coin-



cidence, nor is, Scarlatina incidental to Typhus, as Measles or Chicken Pox may be. They often occur together, in about the same ratio, making it almost impossible to say which is the dominant epidemic. Their concurrence is most frequent in the autumnal months, when Typhus more commonly acquires the epidemic character. This analogy offers an interesting field of research.

#### THE PROBABLE MODE OF ACTION AND COMPOSITION OF THE

**VIRUS.** But one other point relating to the production of Typhus remains to be considered, and that is, the nature of the materia morbi of the affection. We think with Liebig, that the virus acts as a ferment, creating in the ultimate molecules of the system an action similar to its own, an opinion corroborated by the well known effects of the introduction of a minute portion of the various lymph into the system. Now the question may arise, but how can the introduction of putrescent matter into the stomach cause fever, since we all know that the gastric fluid is a powerful antiseptic? The fact we promptly admit, and its inferential question is readily answered. In some cases, the gastric fluid may be deficient in quantity, and in others, a larger quantity of the putrid matter may have gained access to the stomach, than the



usual amount of gastric juice, secreted, can correct. But we would answer the question on another ground, that is, the known solvent power of the gastric secretion, and it is from the fact of its assimilating agency, that we would meet the inquiry. By its solvent action, the gastric fluid assimilates the putrescent matter sufficiently to confer upon it the amount of change needed for absorption and combination with the organic molecules, but not sufficient to neutralize their morbid properties. Hence, the production of disease generally, and specially, of Typhus; thus much for the mode of action of the virus: upon its composition we can only offer conjecture, but it is the conjecture of analogy. We presume then, that the virus of febrile diseases has a strong affinity for Oxygen, as we know the vaccine virus has. It may be a compound of Hydrogen and Carbon in some peculiar, and yet unknown state of combination.

COMMON DIVISIONS OF TYPHUS. Two principal divisions of Typhoid fever are recognized, the putrid malignant, and the slow nervous; to these two others are sometimes added, the inflammatory and the continued.

The so called continued fever is a vague and indefinite appellation including diseases having no resemblance to Typhus. Cullen systematized the



lators of his predecessors, and endeavored to prove the identity of continued and intermittent fevers, by the diurnal exacerbations of the former, but his conclusions were any thing but satisfactory.

**INTERMISSIONS IN TYPHUS.** It cannot be doubted that there are daily exacerbations in Typhus, nay more, it must be admitted that there are intermittent periods of the quartan type, defined by an augmentation of all the febrile symptoms. These periods are clearly observable at the commencement of the attack and may be detected <sup>over</sup> throughout the whole progress of the disease.

Chomel and Louis remarked "that the petechial eruption appears on or about the fourth day," and Rush says, "the eruption of petechiae appears on the fourth or fifth day, and in some cases not until the eleventh or twelfth." Neither the common or petechial mode of Typhus differs from this law, and it will always be found that the petechiae appear on the days of exacerbation. This law of the petechiae equally associates Typhus with Scarlatina and intermittent fevers, hence the term "Continued Fever" is a misnomer.

**CLASSIFICATION OF TYPHUS.** We may advantageously subdivide



Typhus into 1st. Typhus Communis. 2d. Typhus Petechialis and 3rd. Typhus Hecticus. Between the first two the only distinction is the petechial eruption, but as this eruption is in some visitations always seen, and in others, never seen at all, we are justified in making it a line of demarcation in the division.

NATURE OF TYPHUS HECTICUS. This is the most fatal form Typhus can assume, it may commence with symptoms apparently light, or excessively severe, if slight, the more insidious; if severe, the less controllable by art. It is the "Adynamic Fever" of the French, and the "Low Nervous Fever" of the older writers; the Algide Fever is without doubt one of its modifications. We use the term hectic in its common sense, and because it is descriptive of that which in all other diseases is included in it, to wit: - an erysipelatous affection of the mucous membrane of the bowels.

The symptoms developed by this modification of fever, are the same as those described as proper to hectic. The following from Huxham is to the point: - "The pulse during all this time is quick, weak, and unequal, sometimes fluttering, and sometimes slow for a few minutes, (intermitting,) and then with a sudden flush in the face, immediately



very quick, and then again surprisingly calm and equal, thus alternating. The heats and chills are uncertain and unequal, sometimes a sudden glow and color in the cheeks, while the tip of the nose and the ears are icy cold, and the forehead is in a cold dewy perspiration. The tongue at first is seldom dry or discolored, but sometimes covered with a thin whitish mucus, at length it often appears very dry, red and chapped, of the color of Pomegranate Rind. The delirium is seldom violent but as it were, a confusion of thought and action, with muttering and faltering of speech. Frequently profuse sweats pour out all at once about the eighth or twelfth day, commonly coldish and clammy on the extremities; very thin stools, the sweats and purging are colligative and very prostrating. Lastly, involuntary exertions and subsultus tendinum, the prelude to a general convulsion which snaps the thread of life." The above is a graphic description of Hectic Fever as it presents in the course of any severe disease. Relapses after Typhus of the first two modes are generally of the hectic character.

#### DIAGNOSIS BETWEEN TYPHUS HECTICUS AND MUCO-ENTERITIS.

This form of Typhus is not to be confounded with idiopathic inflammation of



the mucous membrane of the bowels, a disease often occurring after epidemic Typhus, but bearing no pathological relation thereto, excepting as regards the mucous membrane. The symptoms are similar, but less severe, and delirium is not so common; in 119 cases reported as occurring in the "University College" (London 1842) five only presented delirium, and it was dependent on Congestion of the Lungs. In Typhus Hecticus, delirium, or severe pain and weight at the back of the head is a constant symptom.

Muco-Enteritis is often epidemic and is probably the disease described by Sydenham as the "Continued Fever of 1673-4 and 5," the correspondence of their symptoms being complete.

The same disease attacking the lungs, is our epidemic Influenza.

FINIS.